



Economic Impact Analysis Virginia Department of Planning and Budget

9 VAC 5-40 – State Air Pollution Control Board Regulations for the Control and Abatement of Air Pollution November 7, 2001

The Department of Planning and Budget (DPB) has analyzed the economic impact of this proposed regulation in accordance with Section 9-6.14:7.1.G of the Administrative Process Act and Executive Order Number 25 (98). Section 9-6.14:7.1.G requires that such economic impact analyses include, but need not be limited to, the projected number of businesses or other entities to whom the regulation would apply, the identity of any localities and types of businesses or other entities particularly affected, the projected number of persons and employment positions to be affected, the projected costs to affected businesses or entities to implement or comply with the regulation, and the impact on the use and value of private property. The analysis presented below represents DPB's best estimate of these economic impacts.

Summary of the Proposed Regulation

The proposed regulations will establish emission standards for particulate matter, carbon monoxide, dioxins/furans, hydrogen chloride, sulfur dioxide, nitrogen oxides, lead, cadmium, and mercury, which will apply to commercial/industrial solid waste incinerators. To ensure proper facility operation and compliance with the emission limits, requirements for emissions testing and monitoring, operator training and qualifications, record-keeping, reporting, registration, permitting, siting, and developing waste managements plans are also proposed. These regulations are proposed to meet the requirements of sections 111(d) and 129 of the federal Clean Air Act, and 40 CFR part 60 subpart DDDD of federal regulations.

Estimated Economic Impact

Introduction

The proposed regulation is the result of the continuing effort of the U.S. Environmental Protection Agency (EPA) to control emissions from small incinerators and will apply to

commercial/industrial solid waste incinerators (CISWIs) that burn non-hazardous solid waste and that commenced construction on or before November 30, 1999. These facilities combust commercial/industrial solid waste, which include garbage, refuse, sludge, and other discarded materials such as solid, liquid, semisolid, or contained gaseous materials resulting from agricultural, industrial, commercial, mining operations, and from community activities. Examples of commercial/industrial solid waste are insulation materials, sheetrock, carpet and padding, plastics, paper, cloth, metals, sweepings, dry sludge compounds, and automotive fluff.

These regulations will apply to both existing and new CISWIs. Existing plants will be subject to emissions guidelines while new plants will be subject to the new source performance standards, which are more stringent. Existing plants are those for which construction commenced on or before November 30, 1999 and new plants are those for which construction, modification, or reconstruction began after that date.

Hazardous waste and the waste that is not recyclable or compostable must be disposed. The two primary types of disposal practices are landfilling and incineration. Landfills are facilities for long-term containment of solid waste. An alternative method of managing solid waste is through incineration. Solid waste incineration involves burning of all or a portion of the solid waste stream in specially designed solid waste combustion facilities and the disposal of the residual ash in landfills. Incineration reduces the mass of waste up to 90 percent¹ and results in considerable savings in landfill capacity, but also creates various kinds of toxic emissions. In 1998, Virginia generated about 9 million tons of solid waste, recycled 35%, incinerated 18%, and landfilled 47% of this amount.²

Emissions from CISWIs contain harmful organics such as dioxins/furans, metals such as particulate matter, cadmium, lead, mercury, and acid gases such as sulfur dioxide, hydrogen chloride, and nitrogen oxides. These emissions can cause or contribute to air pollution that may endanger public health and welfare. Some of the pollutants emitted are highly toxic and can cause serious health effects in humans. Emissions of oxides of nitrogen and sulfur contribute to acid rain, which is known to harm lakes, forests, and buildings, as well as public health.

¹ Source: EPA

² Ibid.

It is estimated that the proposed regulations may apply approximately 50 to 90 incinerators in Virginia. However, the agency's (Department of Environmental Quality) emissions inventory database does not allow determining the exact number of units that will be subject to the proposed emissions standards. Currently, between 50 and 90 units located throughout the state may meet the overall criteria for "commercial/industrial solid waste incinerator." These units vary widely with respect to size, technology, purpose, frequency of use, and age. Some units are part of large industrial facilities, while some are small, run intermittently, and belong to small businesses. The emissions from these units must be reduced by the application of "maximum achievable control technology," which is defined as the technology that would result in emissions reductions as high as that can be achieved by the best controlled combustion unit, taking into account the costs and benefits of compliance.

The proposed requirements

The proposed regulations will establish emission standards for particulate matter, carbon monoxide, dioxins/furans, hydrogen chloride, sulfur dioxide, nitrogen oxides, lead, cadmium, and mercury, which will apply to CISWIs. Standards for visible emissions, fugitive dust/emissions, odor, and toxic pollutants have been established in other regulations and incorporated by reference. Since those standards already established elsewhere and apply to CISWIs, this analysis does not address them. Proposed emission limits for existing CISWIs are summarized in Table 1.

A distinguishing feature of the proposed regulations is that they do not prescribe how to achieve the standards summarized in the table. The source has complete control on the method by which the standards will be met. The affected sources are likely to employ the most cost effective methods to comply with the standards and promote innovation in emissions control technology. This feature is likely to result in relatively low compliance costs. The magnitude of savings depends on how many different technology options are available for controlling emissions.

In addition to the emission limits, general operating practices will be established in the form of an operator training and qualification program. A compliance schedule with specific increments of progress is provided. Operating limits for operating parameters such as maximum charge rates, temperature limits, and carbon feed rates and usage are prescribed. Test methods to

Table 1: The proposed Emissions Limits

Pollutant	Emission Limit^{a, b}
Particulate Matter (PM)	70 mg/dscm
Carbon Monoxide (CO)	157 ppm by dry volume
Dioxins/Furans (toxic equivalency basis)	.41 ng/dscm
Hydrogen Chloride (HCl)	62 ppm by dry volume
Sulfur Dioxide (SO ₂)	20 ppm by dry volume
Nitrogen Oxides (NO _x)	388 ppm by dry volume
Lead (Pb)	0.04 mg/dscm
Cadmium (Cd)	0.004 mg/dscm
Mercury (Hg)	0.47 mg/dscm

^a Emission limits are measured at 7 percent oxygen on a dry basis at standard conditions.

^b The list of acronyms used in the table is the following: mg stands for milligrams, dscm stands for dry standard cubic meter, ppm stands for parts per million, ng stands for nanograms.

be used in determining compliance with the emission limits, as well as compliance requirements, including testing schedules, are specified. Air curtain incinerators that burn 100 percent yard waste will have to meet separate requirements for increments of progress, compliance monitoring and testing, record-keeping, and reporting. Procedures to be followed in the event of facility and control equipment maintenance or malfunction are provided.

Initial and annual stack testing will be used to measure the emissions levels and to demonstrate compliance with the standards. Equipment necessary to monitor compliance with the site-specific operating limits are to be installed, calibrated, maintained, and operated. The reporting of emissions will be required once a year, unless emission limits are exceeded, in which case reporting is required twice a year. Records of monitoring and test results are to be maintained.

Operator training and certification requirements are proposed to ensure good operating practices that contribute to the overall effectiveness of the plant operations, which in turn, may reduce the amount of emissions. CISWI unit operators will be required to complete a generic and a site-specific operator-training course. According to the agency, operators are already required to complete a generic training. However, the proposed regulation will introduce an additional requirement for plant specific training on all employees who might affect plant operations. A site-specific documentation must also be developed for each CISWI, must be accessible to operators, and all of the operators must review it annually through a program.

In addition, the owners of new CISWIs applying for a construction permit will be required to prepare a siting analysis. A siting analysis is used to identify and limit the potential effects of a proposed facility on public health and the environment. The effects of CISWI emissions on environment include impacts to the ambient air quality, visibility, and soils and vegetation.

In short, the owners of CISWIs will have to conduct initial and periodic emissions testing, install and operate emission monitoring systems, monitor waste load levels, train operators and obtain certification for some operators, develop site specific operating documents to ensure compliance with the proposed regulations. All of these requirements will have to be satisfied according to a schedule. A compliance schedule with specific increments of progress is proposed. CISWIs will have two deadlines, as follows.

Increment 1, Submit final control plan: Within six months of the effective date of the proposed standards.

Increment 2, Final compliance: Within three years of the effective date, or before December 1, 2005, whichever is earlier.

The agency indicates that the plan approval and consequently, the effective date are likely to be around the 2005 deadline.

Costs

Total costs of this regulation for affected entities will depend on the particular characteristics of each source. Costs will vary significantly for each unit due to the relative size and complexity of each source. The definition of "commercial/industrial waste incinerators" covers many different types of incinerators combusting different materials in support of various

industrial processes located within a wide variety of industries. Potentially affected sources in the Commonwealth range from large units located at large manufacturing facilities, to very small, infrequently operated units located at smaller facilities.

The costs for testing, monitoring, and reporting vary considerably from one source to another and from one pollutant to another. A single stack test for pollutants such as particulate matter, sulfur oxides, or nitrogen oxide may cost anywhere from \$2,000 to \$10,000 per pollutant depending on the pollutant emitted, stack size, and complexity of the test required.³ Installing continuous emission monitors for a single point in a facility may cost anywhere from \$25,000 to \$150,000 per pollutant, without a data acquisition system.⁴

Section 129 of the Clean Air Act requires that all incinerators operate with a Title V permit, and this regulatory program will implement that requirement. It is likely that the majority of the affected sources already have permits to operate, as well as Title V operating permits. According to the agency, approximately 10 percent of the affected sources may need to revise their permits to reflect potentially significant changes in operation in order to meet the requirements of the regulation. This could cost a source, depending on company resources, between \$10,000 and \$30,000.⁵ Some companies may prepare the required analysis with their own staff and some may rely on consultants. A number of sources that have been exempt may need to obtain permits, including a Title V operating permit. If a parent facility already has or is in the process of getting a Title V permit, or if the source otherwise meets Title V applicability requirements, then that source may already have a permit. There may be some sources that do not otherwise meet the need to have a Title V permit other than the existence of this rule. Depending on the specific source, a complete set of new permits could cost between \$20,000 and \$200,000, although it is very unlikely that sources that currently do not have permits will have any significant permitting requirements.⁶ The amount of additional costs to facility owners due to permit requirements is not known.

³ Source: The agency

⁴ Ibid.

⁵ Ibid.

⁶ Ibid.

The additional reporting costs will depend on the specific requirements for the source. Small facilities and sources meeting the emission limits will have less reporting responsibilities than the large facilities and those who do not meet the standards.

Currently, an incinerator operator has to pay \$150 to take the examination and obtain a license, \$75-fee for the initial application, \$50-fee for the biennial certification renewal. Private companies conduct training needed to qualify to take the exam. The cost of an operator-training course ranges from approximately \$400 to \$800. Although these costs are currently incurred, the proposed regulations will require additional site-specific operator training. The additional costs for the site-specific training are not known. The additional training costs may be incurred by the operator, or by the facility owner.

In short, the proposed regulations will impose many different types of costs on the owners of CISWIs. These costs can be grouped under capital and operating cost categories. Capital costs include outlays on control, monitoring, and any other types of equipment purchases and installation expenses required to comply with the proposed standards. Capital costs are one-time costs and are not very meaningful unless converted to annual figures based on the useful life of the capital equipment. Operating costs are ongoing costs and stem from the operation and maintenance of installed equipment, testing, monitoring, reporting, record-keeping, operator training and certification, and any other activities necessary to comply with the proposed regulations. Total annual cost is the sum of the annualized capital costs and operating costs, and is used to measure the impact on the owners of CISWIs.

As it is clear from the information provided so far, the proposed requirements are numerous and complex. Given the absence of facility-specific cost data, it is impossible to identify each cost item for each specific plant affected in Virginia. Instead, the unit costs estimated by EPA will be provided. EPA has already produced an analysis on the economic impact of the commercial and industrial solid waste incinerator regulations.⁷ The unit cost estimates presented here are derived from the EPA analysis.

To estimate the total costs, EPA analysis considers three different model units. The characteristics of these units are provided in the following table.

⁷ EPA, 1999, "Economic Impact Analysis of Proposed Commercial and Industrial Solid Waste Incineration Regulation."

Table 2: Characteristics of Model Incinerator Units

Model Parameters	Model A	Model B	Model C
Waste Type	Sludge/Liquid	Solids	Solids
Technology	Excess Air	Excess Air	Excess Air
Chamber Design	Single Chamber	Single Chamber	Multiple Chamber
Waste Charging	Continuous	Batch	Intermittent
Capacity	1,500 lbs/hr	100 lbs/hr 500 lbs/batch	1,500 lbs/hr
Operating Time	4,719 hrs/yr	2,838 hrs/yr	2,838 hrs/yr

Source: EPA, 1999, "Economic Impact Analysis of Proposed Commercial and Industrial Solid Waste Incineration Regulation," p. 5-2.

Since the costs of the proposed emissions standards will vary depending on the additional controls required, estimated operating costs for each of the affected model units is tabulated, as follows.

Table 3: Unit Cost Estimates for the Affected Facilities^a

Existing Controls	Additional Controls Required	Model A Control Costs	Model B Control Costs	Model C Control Costs
Units with Wet Scrubbers	No Additional Control Requirements	\$22,563	\$22,143	\$22,143
Units with Fabric Filters or Dry Sorbent Injection and Fabric Filters	Packed Bed	\$174,162	\$62,477	\$127,772
Units that are Uncontrolled	Wet Scrubbers	\$203,075	\$75,558	\$154,089

Source: EPA, 1999, "Economic Impact Analysis of Proposed Commercial and Industrial Solid Waste Incineration Regulation," p. 5-5.

^a All cost figures are converted to 2001 dollars from 1998 dollars by an inflation factor of 1.09 based on the U.S. producer price index.

Additional costs reported in the table are total annual costs for a unit, which includes annualized capital costs and annual operating costs. The table suggests that the costs of the proposed regulations may be as low as \$22,143 for model B and C units if no additional emissions control equipment is required, and as high as \$203,075 for model A units if wet scrubbers must be installed.

The total cost of the proposed regulations to Virginia businesses is subject to great uncertainty. First, the distributions of CISWIs in Virginia over currently existing controls and over the three types of model units are not known. Second, there is lack of information on the number of CISWIs that will be affected by the proposed regulations. However, general assumptions can be made to produce rough estimates for the total cost of the proposed standards on all of the potentially affected units in Virginia. To provide total cost estimates, it is assumed that all of the Virginia units are uncontrolled, and Model A units make up 12% of the total affected units, Model B units make up 52%, and model C units make up the remaining 36% of the affected facilities.⁸

Table 4: Total Annual Cost Estimates

	50 Units	60 Units	70 Units	80 Units	90 Units
Total Annual Cost	\$5,956,560	\$7,147,872	\$8,339,184	\$9,530,496	\$10,721,808

The figures in Table 4 suggest that if 50 units become subject to the proposed emissions standards and none of them have any emissions controls installed currently, then the total annual cost is likely to be about \$5.9 million. Similarly, if 90 units are affected in Virginia, then the total compliance cost can be as high as \$10.7 million.

It is important to note that these estimates should be taken as the maximum likely costs for these facilities as they were obtained assuming that the facilities do not have any control equipment installed currently, and that the facility will not switch to a more cost effective waste disposal alternative. Recycling and landfilling may be very attractive ways of waste disposal

after the proposed changes becomes effective. If recycling and landfilling become cheaper methods, it is very likely that these facilities will change their waste disposal method to avoid higher costs provided alternative methods of incineration are available. EPA analysis indicates that at least 50% of the facilities will find it economically cheaper to employ an alternative method of disposal such as landfilling. Switching to less costly disposal alternative is likely to reduce the estimated compliance costs.

These additional costs may cause some of the facilities to cease operations and may discourage commercial industrial facilities to use incinerators. As mentioned, this may be because landfilling may be cheaper or additional costs may encourage recycling. The agency anticipates that approximately 10% of sources still operating by the time the regulation is effective will shut down in order to avoid meeting the new regulatory requirements. Whether a facility opts to install control equipment, change their operations such that the addition of equipment is not necessary, or seek an alternative to incineration, cannot be accurately predicted.

For example, one unit located at a large manufacturing facility has been in operation for many years, and performs one unique task on a case-by-case basis. The unit has no air pollution control devices, nor does it burn large quantities of waste. Further, this unit has been operated only intermittently over the years, depending on the type and amount of product it is intended to process. Due to the constant evolution of the parent facility's numerous processes, use of this unit has decreased significantly over the last several years, and has not been operated at all for over a year. While it is unlikely that the unit will be used again, the facility is considering whether it should be maintained in order to meet an unanticipated manufacturing need that may occur at a later date, to adapt it to meet additional or different purposes, or to replace it. The parent facility is currently in the process of weighing the unit's future usefulness against the likelihood of adding controls and incurring other costs as required by the regulation. In short, such decisions are dependent on many factors and cannot be accurately predicted.

Additionally, the economic impact of the proposed standards would be relatively more significant for the new units because they will be subject to more stringent new source performance standards. However, the EPA analysis anticipates that even in the absence of the proposed standards, no CISWIs will come online. Provided no new units come online in

⁸ This distribution is consistent with the sample used in EPA analysis.

Virginia, there should be no economic impact due to proposed new source performance standards.

It should be also noted that some of these costs may have been already incurred. Some of the facility owners have been anticipating the proposed regulations and may have been already taking necessary steps to meet the proposed emissions standards. According to the agency, Virginia's potentially affected facilities, especially large incinerators, may have already installed the control equipment. Many of the sources are believed to have already obtained permits, established testing and record-keeping procedures, and trained and licensed operators. Thus, these facilities may have to incur only limited additional costs beyond the costs they have already incurred to realize the full cost of the proposed changes.

Some of the projected costs to the facilities may be passed downstream to customers and upstream to suppliers depending on the characteristics of the industry where commercial industrial facilities operate in. It is usually impossible to pass all of the cost increases to consumers and in most cases the firm can pass at least a portion of the costs. Some of the industry characteristics have been provided in the appendix.

Industry descriptions of potentially affected facilities, their distributions over industries,⁹ the total number of existing firms, four firm concentration ratios, value of shipments, total payroll, and the number of paid employees have been identified. For example, there are 44 establishments in Virginia's miscellaneous manufacturing industries (SIC 39), two of which may be subject to the proposed standards. The value of shipments in this industry was about \$189 million in 1997 and about \$34 million was paid to approximately 1,000 employees. The four-firm concentration ratio also indicates that the four largest firms account for about 13% - 24% of the total value of shipments in this industry.

In general, a low concentration ratio is a characteristic of more competitive markets where firms are price takers and a high concentration ratio indicates that the industry is closer to a monopolistic market structure where firms may influence the prices. It may be easier for firms operating in highly concentrated industries to pass the compliance costs to their customers or their suppliers. According to the EPA analysis, most affected industries are competitive and only a small number of firms in each industry will be subject to the proposed standards. In Virginia,

potentially affected firms may be between 50 and 90 out of over 11,000 firms in similar industries. This is less than one percent of the total number of firms. Thus, it is unlikely that there will be a significant impact on market prices of the goods produced in these industries. If the market price cannot be influenced, then the affected firms with incineration units are likely to bear most of the compliance costs. Based on the available evidence presented here, the economic theory suggests that the compliance costs are likely to be paid out of CISWI profits and not by their customers or other businesses.

Finally, the agency will likely perform additional inspection, monitoring, and record-keeping to ensure that the emissions limitations are being met, which may require increased expenditure in personnel and equipment. However, the agency does not expect additional personnel and equipment needs to be significant because many of these sources have been already permitted, inspected, and monitored for many years. Allocation of additional duties among the current personnel and other resources within the agency is expected to be sufficient to cover small additional staffing that may be required to ensure compliance with the proposed changes. On the other hand, the agency expects to enhance its ability to make both short and long term planning decisions by a small margin through the additional data collected and analyses performed.

Benefits

The main benefit of the proposed standards will be substantially reducing emissions of harmful air pollutants. These regulations will significantly reduce emissions of the eight pollutants mentioned above. For example, nationwide, hydrogen chloride emissions from CISWI units are expected to drop by 89 percent, dioxin/furans by about 65 percent, mercury by 34 percent, and particulate matter by about 71 percent over 1990 levels.¹⁰ Some of these pollutants are considered carcinogens.

The benefits from the proposed standards are expected to be significant as the health risks from small exposures to some of these regulated air pollutants can be high. Some of the emissions are known or suspected of causing cancer, nervous system damage, developmental

⁹ Uses the low-end estimates for the number of potentially affected facilities.

¹⁰ Source: EPA

abnormalities, reproductive impairment, immune suppression, liver dysfunction, hormone imbalance, and other serious health effects.

In particular, dioxin is a significant concern because it is persistent in the environment and bioaccumulates. These characteristics cause dioxin to move through the food chain, biomagnify, and cause adverse effects to humans and wildlife. Reproductive, developmental, and immune system effects associated with exposure to dioxin are significant public health concerns.

Mercury is also highly toxic, persistent in the environment and bioaccumulates, particularly in fish. Human exposure to mercury occurs primarily through ingestion of fish. Exposure to mercury can cause adverse health effects in humans and wildlife, including gastrointestinal and respiratory tract disturbances, central nervous system, birth, and developmental effects.

Lead and cadmium are highly toxic and may cause mucous membrane irritation, gastrointestinal effects, nervous system, reproductive, and developmental disorders, and skin irritation. Long-term exposure to hydrogen chloride may affect eyes, skin, and mucous membranes.

Control of harmful emissions from municipal waste combustors will reduce such serious health effects and the associated treatment costs. Furthermore, the reduction of CISWI emissions will reduce the risk of damage to vegetation and property, and improve visibility. A summary of health and other effects are provided in Table 5 on the next page. The economic value of these benefits cannot be credibly estimated because the uncertainty in doing so is enormous. It is not known how many people are exposed to these harmful emissions. Also, dose-response relationships between exposure to many of these harmful pollutants and the adverse health effects are little known.

Finally, overall ozone reductions may lessen the risk of current attainment areas being designated nonattainment, and current nonattainment areas being reclassified to a more serious classification. Also, failure to implement these regulations may result in federal government intervention.

Table 5: Health and Other Effects of Pollutants

Pollutant	Health and Other Effects
Dioxins/Furans	mortality, morbidity carcinogenicity
Cadmium (Cd)	retardation and brain damage
Mercury (Hg)	hypertension central nervous system injury
Lead (Pb)	renal dysfunction
Particulate Matter (PM)	mortality, morbidity eye and throat irritation, bronchitis, lung damage impaired visibility soiling and Materials damage
Sulfur Dioxide (SO ₂)	dental erosion
Hydrogen Chloride (HCl)	acid rain
Nitrogen Oxides (NO _x)	mortality, morbidity respiratory tract problems, permanent harm to lung soiling and materials damage reduced agricultural yield

Source: Federal Register, Vol. 60, No. 243, p. 65411.

Businesses and Entities Affected

About 50 to 90 facilities are located throughout the state generally meet the criteria for "commercial and industrial solid waste incinerator." When the agency conducts a more definitive inventory as a part of the section 111(d) plan, this number may be revised and the total number of affected units may change significantly.

Localities Particularly Affected

The proposed regulations will apply throughout the Commonwealth.

Projected Impact on Employment

The number of units that may shut down their incinerators is not known, but the agency anticipates that about 10% of the affected CISWIs may shut down their operations due to additional costs introduced by the proposed standards. This is likely to reduce the demand for labor at the incinerator units of the affected facilities. These firms may also reduce their demand for labor employed in the production process due to higher cost of production. On the other hand, affected entities are likely to employ an alternative method of waste disposal such as landfilling, other firms in the industry are likely to increase their production if there is a decrease in supply, and emissions control businesses may increase production. These effects are likely to increase the demand for labor and balance the negative impact to some degree. In fact, EPA analysis indicates that the compliance costs as a percentage of total company sales do not exceed three percent. This is taken as an indication that no significant impact on nationwide employment should be expected. Given the absence of any evidence against EPA's conclusion, the impact of the proposed regulations on Virginia's net employment is not expected to be large.

Effects on the Use and Value of Private Property

The value of the affected firms is likely to decrease because of additional compliance costs and lower profits. However, air pollution control devices will have to be purchased and the vendors will likely experience an increase in demand for their products. Their profits and the value of their businesses are likely to increase. Furthermore, businesses that conduct training of incinerator operators are also expected to experience an increase in the demand for their services. This may positively affect the value of training businesses. Finally, the value of private property located around affected incinerator units may increase due to emissions reductions that will be achieved.

Appendix: Characteristics of Potentially Affected Industries in Virginia^a

SIC	Industry Description ^b	Firms could be Affected	Firms in Industry	Four-Firm Concentration Ratio (%)	Value of Shipments ^c (\$1,000)	Annual Payroll ^c (\$1,000)	Number of Paid Employees
02	Agricultural prod. - Livestock	2	-	-	-	-	-
21	Tobacco manufactures	1	5	62	-	-	1,000-2,499
22	Textile mill products	3	38	24 – 34	\$2,197,343	\$368,157	14,344
24	Lumber & wood products	1	12	43	\$268,839	\$42,693	1,341
28	Chemicals & allied products	3	15	26 – 45	-	-	2,100-5,249
30	Rubber & misc. plastics prod.	4	142	5 – 26	\$2,448,237	\$370,161	12,932
33	Primary metal industries	1	1	22 – 51	-	-	100-249
34	Fabricated metal products ^d	3	157	7 – 62	\$731,444	\$159,864	6,470-7,469
35	Industrial machinery & equip.	2	13	22 – 76	\$904,183	\$157,927	5,431
36	Electrical & electronic equip.	2	25	33 – 41	\$387,401	\$81,301	2,777
37	Transportation equipment ^d	3	59	31 – 53	\$2,254,372	\$826,383	22,235
38	Instruments & related prod.	1	18	57	\$2,254,372	\$826,383	22,235
39	Miscellaneous manufacturing industries	2	44	13 – 24	\$189,434	\$34,496	1,090
50	Wholesale trade-durable good	3	1,356	7 – 13	\$4,489,887	\$482,491	15,873
51	Wholesale trade-non-durable good	2	318	28 – 52	\$7,355,225	\$355,442	12,370
54	Food stores	2	5,185	9 – 90	\$13,457,863	\$1,206,659	99,331-114,331
65	Real estate	1	41	21	\$37,823	\$14,501	468
72	Personal services	2	553	21 – 35	\$339,543	\$98,578	4,838
75	Automotive repair, services, & parking	1	196	2	\$79,364	\$24,208	1,072
76	Misc. repair services	6	784	7 – 48	\$914,330	\$220,699	7,453
80	Health services	1	102	74	\$7,950,293	\$2,927,241	95,609
87	Engineering & management services	2	2,122	11 – 31	\$6,570,862	\$2,797,150	56,932
97	National security	2	-	-	-	-	-
Total		50^e	11,186				

Source: Extracted from 1997 Economic Census, U.S. Census Bureau.

^a Some data are not available because either withheld to avoid disclosure or not found in database.

^b Industry is defined as narrowly as possible. It does not include all the firms under the same two-digit SIC code, but only those very similar to the facility that may be affected.

^c In terms of 1997 dollars.

^d Numbers exclude undisclosed data.

^e This corresponds to low-end estimates for the potentially affected facilities in Virginia.